CLAIMS

1.   Membrane fuel cell delimited by bipolar plates comprising a cathodic compartment and an anodic compartment, said cathodic compartment comprising means for feeding air from bottom to top, said anodic compartment comprising means for feeding a hydrogen-containing fuel from top to bottom, at least one of said cathodic and anodic compartment comprising a flow distributor consisting of a porous material.

2.   The cell of claim 1 wherein said at least one compartment comprising a porous flow distributor is the cathodic compartment.

3.   The cell of claim 1 or 2 wherein said porous material is selected from the group of three-dimensional reticulated materials, sintered materials, juxtaposed meshes, juxtaposed expanded sheets.

4.   The cell of any one of the previous claims wherein said porous material has a porosity dimensioned for generating a gaseous flow pressure variation not higher than 0.5 bar.

5.   The cell of any one of claims from 1 to 3 wherein said porous material has a porosity dimensioned for generating a gaseous flow pressure variation not higher than 0.1 bar.

6.   The cell of any one of the previous claims wherein said porous material has a void volume/total volume ratio not lower than 50%.

7.   The cell of claim 6 characterised in that said ratio is equal or higher than 75%.

8.   The cell of any one of the previous claims comprising a heat extraction device crossed by liquid water in communication with said cathodic compartment through calibrated holes on the relevant bipolar plate delimiting the cell.

9.   Fuel cell stack comprising a multiplicity of cells of the previous claims.

10.   Method for operating the cell of any one of claims from 1 to 8 or the stack of claim 9 wherein said cathodic compartment is fed with air in a dry state and at a pressure lower than 3 bar.

11.   The method of claim 10 wherein said pressure is lower than 1.2 bar.

12.   The method of claim 10 or 11 wherein the temperature of the air discharged

from the upper part of said cathodic compartment is lower or equal to the dew point defined by the ratio of moles of water of reaction/overall moles of discharged air and water vapour.

13.   The method of claim 12 wherein the regulation of said temperature of discharged air is obtained by adjusting the temperature of a cooling fluid circulating inside the cell.

14.   The method of claim 13 wherein said cooling fluid is water injected in the lower part of the cell in the proximity of the air feed.

15.   The method of claim 14 wherein said water is injected in the lower part of the cell through calibrated holes present on the bipolar plate facing said cathodic compartment.

16.   The method of claim 15 wherein said calibrated holes are in communication with a heat extracting device whence said water injected in the lower part of the cell proceeds.

17.   The method of claim 16 wherein the flow-rate of the water flowing in said extracting device is substantially equivalent to the flow-rate if said water injected through said calibrated holes.

18.   The method of any one of claims 14 to 17 wherein the regulation of the flow-rate of said injected water is carried out as a function of the electrical current output.

19.   The method of claim 18 wherein said regulation is achieved by acting on the operating regime of an injection pump.

20.   The method of any one of claims 14 to 17 wherein said injected water and said air feed have a constant flow corresponding to the value required for the maximum nominal electrical output.

21.   Fuel cell substantially as described making reference to the attached drawings.